U.S. DEPARTMENT OF AGRICULTURE
Forest Service

FOREST PEST LEAFLET 48
August 1960

Laminated Root Rot of Douglas-fir

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Laminated root rot is caused by the native fungus *Poria weirii*. It is widespread in northwestern United States and adjacent Canada, and is especially common and damaging to Douglas-fir. Most of the other conifers in this region also become infected, at least occasionally, but none of them, with the possible exception of the true firs, is as susceptible as Douglas-fir.

In Washington and Oregon, this is by far the most destructive root rot of Douglas-fir. Trees of all sizes and ages are attacked, but damage is usually greatest in stands from about 40 to 125 years old.

Description

The disease occurs in patches or centers of infection (fig. 1) often only a few hundred square feet but sometimes an acre or more in extent. Within a typical center will be found several trees, standing or more frequently down, that have been dead for different lengths of time. Roots of the down trees are often broken transversely near the base of the trunk (fig. 2). A few of the living trees in the center may be leaning or may display thin or ragged crowns, poor color, "distress" crops of small cones, or decreased terminal and lateral growth. Bark beetles usually hasten the death of such weakened trees.

Various other pests and disturbances cause somewhat similar openings and crown symptoms but are seldom difficult to distinguish from laminated root rot. For example, in blowdowns and groups of beetle kills where root rot is not involved, most of the killing occurs within a period of 1 or 2 years. In shoestring root rot centers, the distinctive white to cream-colored mycelial fans of *Armillaria mellea* can be found between the bark and the wood at bases of dead or weakened trees.

The most reliable basis for field identification of laminated root rot is the characteristic appearance of the decay. When this is found it can almost always be assumed that *Poria weirii* is the primary cause of the opening in the stand. Incipient

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Figure 1.—A laminated root rot center in an 80-year-old Douglas-fir stand.

decay is reddish brown to brown. In butts and main roots it appears as streaks or broad bands on longitudinal sections and as circular, crescent-shaped, or irregular areas on cross sections (fig. 3). Typical ("advanced") decay is exposed on broken roots of down trees or can be found by chopping into standing dead trees. This decay is lami-

nated—that is, the wood tends to separate along the annual rings—and it contains numerous pockets about one-fiftieth of an inch in diameter and one twenty-fifth of an inch long (fig. 4).

Thin, velvety layers or sparse tufts of brown fungous threads are usually present in crevices in the decayed wood; and thin, brown crusts sometimes form on bark or on surfaces of breaks. In the final stages of decay the wood becomes a loose, stringy mass and eventually may disintegrate completely, leaving hollow butts in occasional trees that have survived infection for many years.

Sporophores of the fungus are brown crusts containing thousands of minute pores. They form on lower sides and in root crotches of down trees during late summer and early fall. Although fairly common, they are too inconspicuous to be useful in detecting the disease.

Spread

New centers of the disease start when spores infect wounds on or near the butts of living trees. Infection within centers spreads from

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Figure 2.—Douglas-fir "rot thrown" as result of attack by *Poria weirii*. Note stubs of decayed roots.

tree to tree by growth of the fungus along roots. The high susceptibility of Douglas-fir may be attributable at least in part to this vegetative method of spread, since root contacts and grafts are believed to be more common in Douglas-fir than in other species.

In stands of pole-size or larger timber, practically all of the trees are infected within 15 feet of a tree killed by laminated root rot. As the distance from the nearest killed tree increases, the percentage of infected trees decreases; and at distances of 50 feet or more, infection is rare.

When an infection center is logged or burned, the fungus continues to live in dead roots, often for 50 years or more. If no other food supply becomes available, the fungus eventually dies. If, however, the area is reoccupied by susceptible tree species before the fungus has died, some of the roots of the new stand may grow into contact with buried infectious ma-

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Figure 3.—Cross section from base of Douglas-fir, showing incipient and typical decay caused by *Poria weirii*.

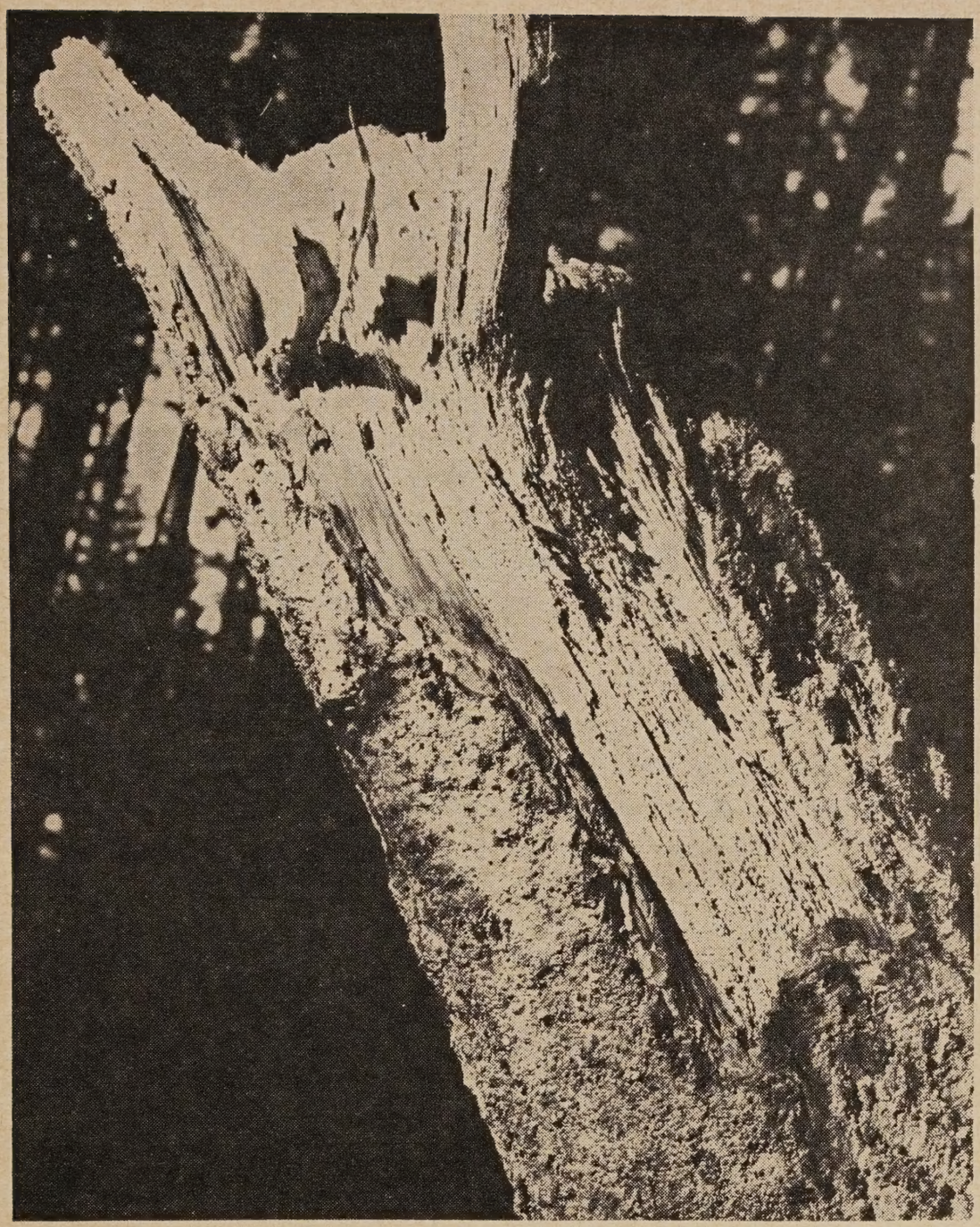

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Figure 4.—Closeup of typical decay caused by *Poria weirii*. Note small pockets and separation of annual rings.

terial. The disease then spreads from root to root, and the infection center reappears in the new stand.

Damage

Poria weirii is important principally as a killer. The heart rot that it causes in living trees seldom extends far above the stump and has relatively little effect on yield. Damage consists almost entirely of loss of actual or potential volumes as parts of the stand are destroyed at infection centers.

In young forests, damage increases in geometric proportion to stand age as infection centers gradually becomes larger and more numerous. Infection is much less abundant in some localities than in others, and it is difficult to predict where damage will become severe enough to warrant special measures to diminish losses. As a

rough rule of thumb, it may be assumed that damage will be doubled about every 15 years during the period when the disease is most active. Therefore, if infection centers are common in a stand of small poles, serious damage must be expected before the trees reach sawtimber size, even though losses to date may have been negligible.

Control

No practical method of direct control is known, but losses can often be reduced by appropriate management practices.

When stands are to be clear cut over a period of several years, yields can be increased by cutting first those logging units where root-rot mortality is greatly reducing net increment, and by leaving until last those units where the highest net increment is still being obtained.

In stands where the final cut is to be deferred but where logging of small volumes is practicable, the larger infection centers and groups of centers, including immediately adjacent trees, may be clear cut in order to salvage values that will otherwise be lost within the next few years. On and near infection centers, partial cuts are advantageous only for salvage of dead and dying trees and for release of less susceptible species. Infected Douglas-firs seldom respond well to release from competition, and those that do respond will seldom survive long enough to make good use of the added growing space. As far as is known, neither clear cutting nor partial cutting in merchantable stands has any effect on spread of the disease, although partial cutting may hasten windthrow of remaining infected trees.

Where severe damage by laminated root rot has occurred during one rotation, it is likely to be even more severe during the next. In extreme instances, potential yields of Douglas-fir may be insufficient to justify expenditures for planting. On such areas the most profitable procedure may be to reduce costs by relying on natural regeneration, and to favor less susceptible species—such as western hemlock—in subsequent stand improvement operations.

References

A ROOT ROT OF DOUGLAS FIR CAUSED BY PORIA WEIRII. IRENE MOUNCE, J. E. BIER, and MILDRED K. NOBLES. Canad. Jour. Res. C 18: 522–533, illus. 1940.

RELATION OF RESEARCH IN FOREST PATHOLOGY TO THE MANAGEMENT OF SECOND GROWTH FORESTS I. PORIA WEIRII ROOT ROT, AN IMPORTANT DISEASE AFFECTING IMMATURE STANDS OF DOUGLAS FIR. J. E. BIER and D. C. BUCKLAND. Brit. Columbia Lumberman 31: 49–51, 64, 66, illus. 1947.

PORIA WEIRII: ITS OCCURENCE AND BEHAVIOR ON SPECIES OTHER THAN CEDARS. T. S. BUCHANAN. Northwest Sci. 22: 7–12. 1948.

YELLOW LAMINATED ROOT ROT OF DOUGLAS FIR. D. C. BUCKLAND, A, C. MOLNAR, and G. W. WALLIS. Canad. Jour. Bot. 32: 69–81, illus. 1954.

THE CONTROL OF YELLOW LAMINATED ROOT ROT OF DOUGLAS FIR. D. C. BUCKLAND and G. W. WALLIS. Forestry Chron. 32: 14–19. 1956.

U.S. GOVERNMENT PRINTING OFFICE: 1960